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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/790,606	03/01/2004	Jiong-Ping Lu	TI 37479	9593

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EXAMINER	
TRAN, LONG K	
ART UNIT	PAPER NUMBER
2818	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	04/11/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/790,606	LU, JIONG-PING	
	Examiner	Art Unit	
	Long K. Tran	2818	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 January 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10,14,15 and 17-24* is/are pending in the application.

4a) Of the above claim(s) *1-9,17 and 20* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *10,14,15,18,19 and 21-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. This office action is in response to Amendment filed on 01/22/2007.

2. Claims **11 – 13** and **16** have been cancelled.

3. Claims **10, 14, 38** and **50** have been amended.

4. Claims **23 – 24** have been added.

5. Claims **10, 1 4, 15, 18, 19** and **21 – 24** are presented for examination.

Response to Arguments

6. Applicant's arguments with respect to claims 10, 14, 15, 16, 18, 19 and 21 have been considered but are moot in view of the new ground(s) of rejection. In addition, the claimed languages of claim 10 do not clearly express limitations "*this process in order*" as cited in the applicant's argument (page 8, lines 8 – 15).

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claim **10,** are rejected under 35 U.S.C. 102(b) as being anticipated by Chen et al. (US 6,162,713).

9. Regarding claim **10**, Chen, figures 4A – 5H, discloses a method for manufacturing a semiconductor device, comprising:

placing a gate oxide (410), (510) over a silicon substrate (400), (500);

forming a silicided gate electrode (480), (570) over said gate oxide 2(410), comprising:

place a layer of polysilicon material (420), (520) over said layer of gate oxide material,

forming a layer of an alloy (440), (540) comprising $TiSi_xM_y$ (where M is selected from the group consisting of Ta, Nb and Mo; column 5, lines 1 – 11),

annealing said layer of said alloy comprising said first metal and said second metal to form a layer of silicided gate electrode material including said first metal and said second metal (column 1, lines 34 – 42; column 4, lines 3 – 6)'

patterning said layer of silicided gate electrode material to form a silicided gate electrode ((480), (570); column 4, lines 25 – 27).

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claims **18** and **19** are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. (US 6,162,713) in view of Ku et al. (US 2004/0266182).

12. Regarding claim **18**, Chen discloses the claimed invention of claim 10 but fails to disclose a ratio of an atomic percent of the cobalt to a thickness of the nickel in the silicided gate ranges from about 9:1 to about 2:3 as cited in the present claim.

Ku shows an alloying metal used in conjunction with a primary nickel component is cobalt ([0017]) and is about 10 atomic percent of the nickel alloy.

It would have been well known in the art of making semiconductor devices to form the workable or optimal range for a ratio of an atomic percent of the cobalt to a thickness of the nickel in the silicided gate ranges from about 9:1 to about 2:3 through routine design of experimentation (DOE) and optimization to obtain optimal device performance. In addition, the applicant has stated in the application description ([0027] lines 9 and 10) that "the ratio may vary depending on the application".

Regarding claim **19**, Cabral discloses the claimed invention of claim 10 and MOS gate structure but fails to disclose forming source/drain regions in the substrate and forming silicided source/drain regions in the source/drain regions subsequent to forming the silicided gate electrode.

However, Ku shows forming source/drain regions 28 (figure 2B; [0037]) in the substrate 10 (figure 2B) and forming silicided source/drain contact regions (34D; [0038]) to provide metal patterns for connecting the individual transistors to the remainder of the device circuitry ([0039]).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to adding method for manufacturing a semiconductor device of Cabral with a step of forming source/drain regions in the substrate and forming silicided

source/drain regions in the source/drain regions subsequent to forming the silicided gate electrode as taught by Ku, in order to provide metal patterns for connecting the individual transistors to the remainder of the device circuitry ([0039]).

13. Claims **21** and **22** are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. (US 6,162,713) in view of Amos et al. (US 6,846,734).).

Regarding claims **21** and **22**, Chen discloses the claimed invention of claims 10 and 18 or claim 10 respectively except for the first metal is cobalt and second metal is nickel.

However, Amos discloses the first metal for the alloy layer are Co or Ni and the second metal are Co or Ni (column 9, lines 10 – 25).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to form the alloy of Chen with an alloy of Amos having a first metal being cobalt and second metal being nickel, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice.

14. Claim **24** is rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. (US 6,162,713) in view of remarks.

15. Regarding claim **24**, Chen discloses the claimed invention of claim 10 except for a ratio of a thickness of the layer of polysilicon material to a thickness of the layer of the alloy is at least approximately 3.6:1. However, it would have been well known in the art

that the selection of those parameters such as **energy, concentration, temperature, time, molar fraction, depth, thickness, etc.**, would have been obvious and involve routine optimization which has been held to be within the level of ordinary skill in the art. "Normally, it is to be expected that a change in **energy, concentration, temperature, time, molar fraction, depth, thickness, etc.**, or in combination of the parameters would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art ... such ranges are termed "critical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

16. Claim **23** is rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. (US 6,162,713) in view of Lee (US 5872057).

Regarding claim **23**, Chen discloses the claimed invention of claim 10 but does not explicitly teach a dopant into the polysilicon material affecting a work function of the silicided gate electrode.

However, lee discloses the typical silicided gate electrode having polysilicon layer (22) may be doped to further improve its conductivity (column 2, lines 4 – 14).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to provide the polysilicon material of silicided gate electrode of Chen with an doped polysilicon as taught by Lee, in order to improve the conductivity.

17. Claims **14** and **15** are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. (US 6,162,713) in view of Lee (US 5872057). And further in view of Amos et al. (US 6,846,734).

18. Regarding claims **14** and **15**, Chen and Lee disclose the claimed invention of claims 10 and 23 and a capping layer (450)/(460), (550)/(560) over the layer of the alloy but does not explicitly teach the capping layer comprises transition metal-nitride.

However, Amos discloses a capping layer (60), comprising a transition metal nitride such as TiN, is formed on the surface of the metal alloy (58) (column 9, lines 42+) for preventing oxygen from diffusing into the structures which in turn effect a doping profile of the dopant

It would have been obvious to one having ordinary skill in the art at the time the invention was made to form the capping layer of Chen with an TiN capping layer of Amos, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice.

Conclusion

19. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Long K. Tran whose telephone number is 571-272-1797. The examiner can normally be reached on Mon-Thu.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, MinSun Harvey or Matthew Smith can be reached on 571-272-1835 or 571-272-1907 (Smith). The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should

you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free).

Long K. Tran
Primary Patent Examiner

April 4, 2007